Smart Grid: How it Creates Disruptive Change

Systems and Software Technology Conference

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- Topics:
  - Background—Mega Trends/Issues
  - Smart/Intelligent Grids-Characteristics
  - Advanced Metering Infrastructure (AMI)
  - A Look Inside the Power Companies
  - Why IT and OT need to Merge
  - Implications for DoD
  - Did You Know?

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- Global Security
- Energy Security
- Energy Production—least transformed over the last 20 years
- Climate Change
- Financial Crisis
- Battery Technology-Tesla, Volt, Leaf
- Acceleration of Future--Kurzweil
- Fuel Producing Algae—Ventor
- Solar-to-Salt
- "Prosumer"

Source: Kristian Seenstrup & Zarko Sumic, Gartner

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Nisson Leaf—Zero Emissions

Tesla Sedan

Tesla Coupe

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- Characteristics:
  - **Self-healing**—Adaptive
  - **Interactive** with consumers and markets
  - **Empowering** to customers
  - **Optimized** to make the best use of resources and equipment
  - **Predictiv**e rather than reactive-to reduce emergencies
  - **Integrated**—merges monitoring, control, protection, maintenance
  - **More Secure** from attack

Source: Kristian Seenstrup & Zarko Sumic, Gartner

- Defined:
  - Advanced Metering Infrastructure (AMI) refers to systems that measure, collect and analyse energy usage, and interact with advanced devices such as electricity meters, gas meters, heat meters and water meters, through various communication media either on request (on-demand) or on pre-defined schedules. This infrastructure includes hardware, software, communications, consumer energy displays and controllers, customer associated systems, meter data management (MDM) software, supplier and network distribution business systems, etc.   --Wikipedia
- Smart meters

Photo Capture directly from the PDA

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- Horizontally integrated processes, partnerships, people & information

- Balanced performance, customer satisfaction, regulatory compliance, profit, cash flow, asset utilization

- Timely response to customer needs, demand peaks, supply disruptions, physical and cyber attacks

- Real-time visibility across generation assests, T&D networks and market transactions

- Consumers selling electricity back to the power company

Source: Kristian Seenstrup & Zarko Sumic, Gartner

- Pricing
  - Total Consumption
  - Time-of-use
  - Critical peak pricing
  - Real-time pricing
- Demand response
  - Load control
  - Demand reserves
  - Critical peak rebates
- Customer Feedback
  - Monthly bill & detailed report
  - In-home web display

Source: Chris King

- Customer bill savings
  - Turn off appliances
  - Shift Appliances off peak
  - Manual or automatic control
- Outages
  - Automatic detection
  - Verification of restoration at home level
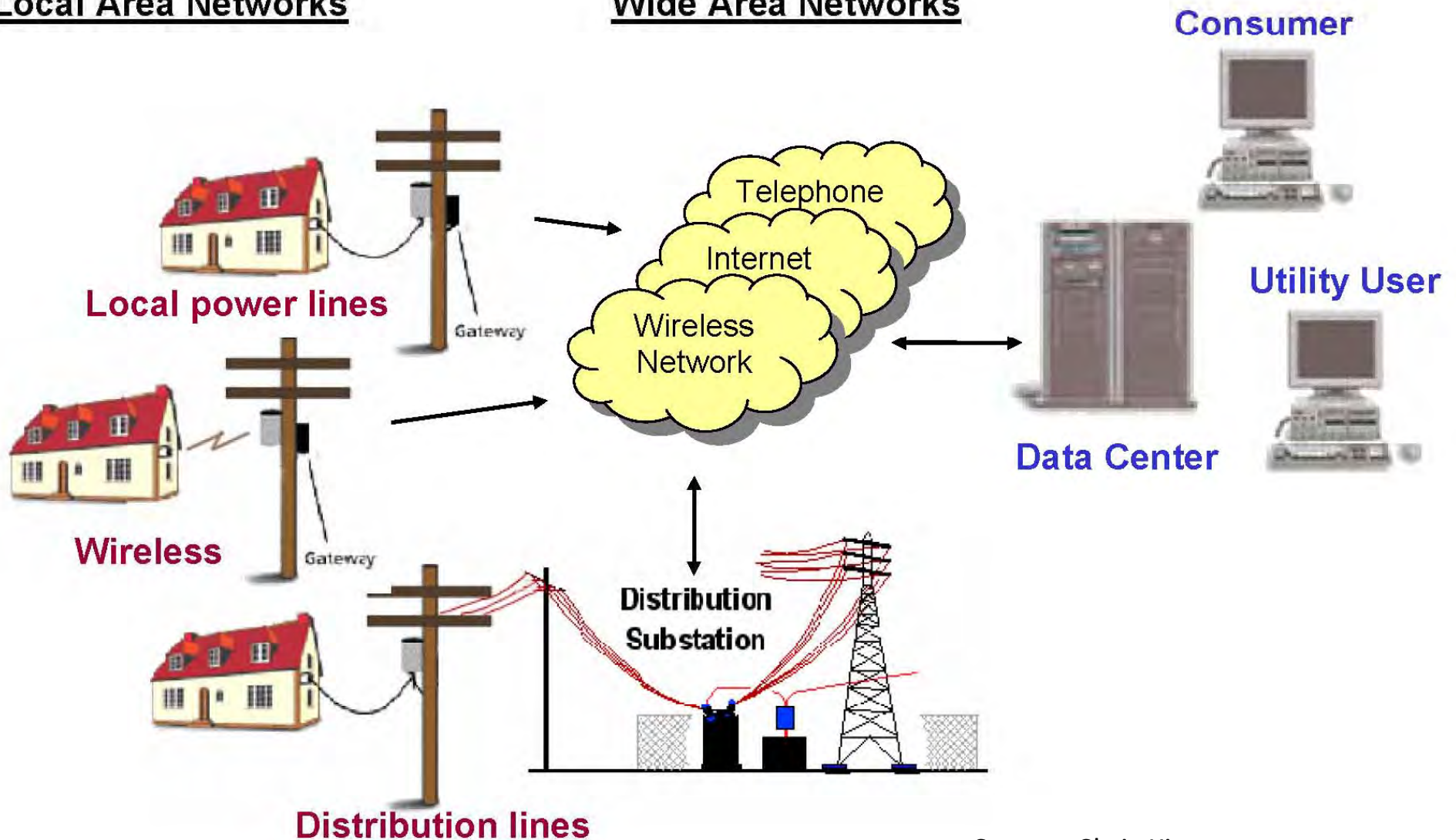- Distribution operations
  - Dynamic, real-time operations

Source: Chris King

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AMI Communication Networks

Source: Chris King

AMI Data and Software Relationships

Contact

User Name

Account

End User

Premise

Circuit

Transformer

AMI Operations

Outage Management System

Web Usage Display

In-Home Display

Smart Thermostat

Load Controller

Electric Meter

Network Module

Electric Service Point

Networks
• Wide area
• Neighborhood
• In-home

Network Providers

Field Technician

Firewall

Data Center

Distribution Operations

Program Management

Billing and Customer Service

Source: Chris King
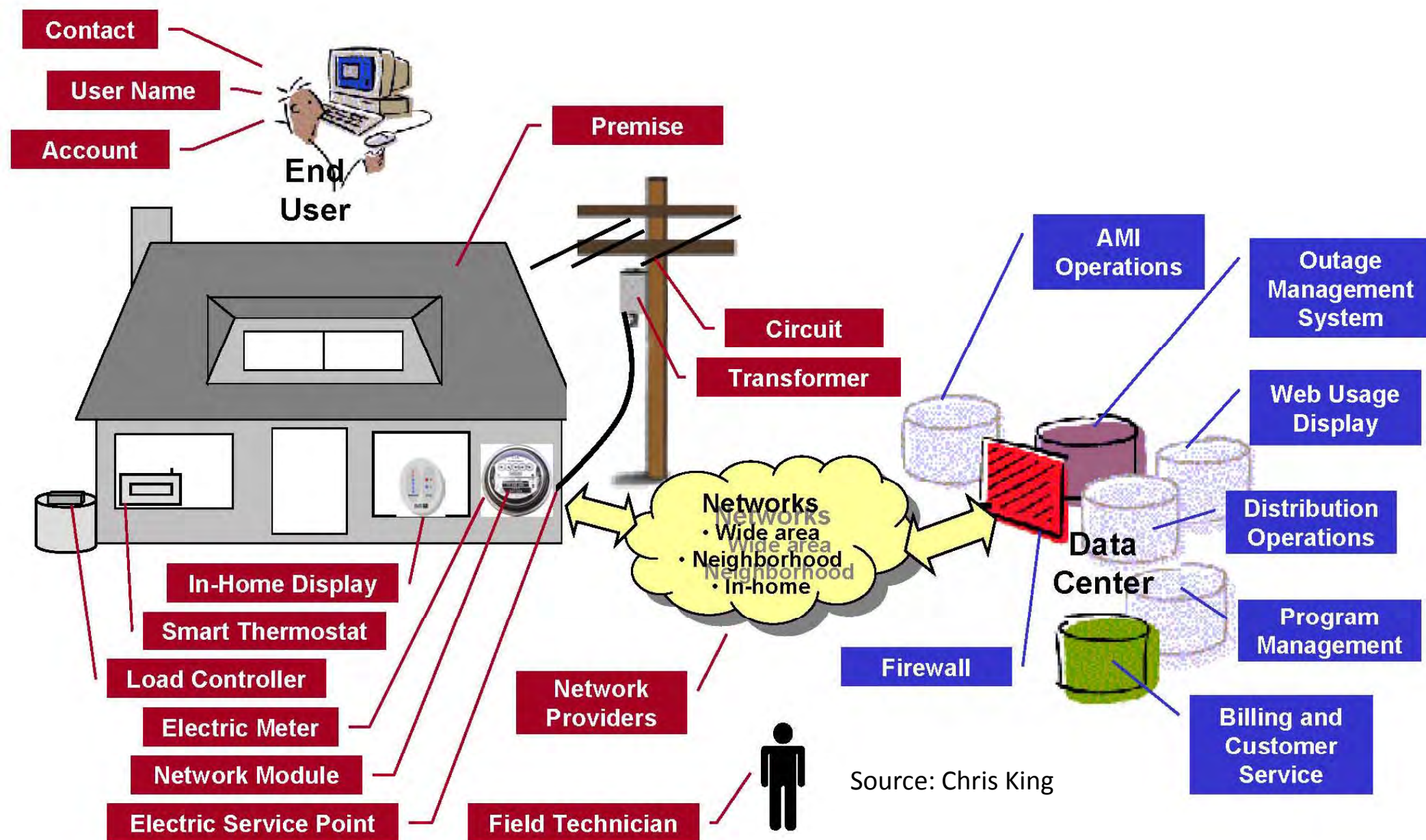
- The divide between the IT and Operational Technology
- The CIO side thinks in terms of:
  - Managing information and automating business processes (think computer scientists)
    - Enterprise network
    - ERP
    - Finance
    - HR, Payroll
- The OT, operations side thinks in terms of:
  - Managing assets, technology controlling processes (think engineers)
    - Automatic Generation Control (AGC)
    - Supervisory Control And Data Acquisition (SCADA)
    - Emergency Management System (EMS)
    - Distribution Asset Analysis (DAA)
    - Programmable Logic Control (PLC)

Source: Kristian Seenstrup & Zarko Sumic, Gartner

- Anticipated data glut
- Aging infrastructure
  - Many power plants and distribution systems are operating at or beyond capacity
- Cultural change takes time, perhaps a generation
- Intersection of:
  - Operational Technology
  - Information Technology
  - Compliance
  - Going Green

Source: Kristian Seenstrup & Zarko Sumic, Gartner

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- Intelligent grid and AMI can make DoD smarter about how it used energy and thereby open doors to reduce consumption

- New technologies will allows DoD buildings and vehicles to become power generators

- DoD needs to worry about SCADA systems that are unprotected by the Utility companies that provide power
  - This especially applies to power stations owned and operated by DoD
  - Similarly, just as CIOs worry about having two separate network providers for their base, so to commanders be concerned if they do not have two separate sources of power

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- The division between IT and OT in the power companies is an issue
  - Power companies slow to consolidate the two will not be able to handle the impending data glut thereby delaying anticipated savings by the consumer and possible interruptions to power generation
  - The slower the companies are to move to the new model may delay the fixing of vulnerabilities currently in the system.
  - The Data glut
    - Storing it
    - Making sense of it
- An example in Iraq
  - Cost of diesel vs. use of solar

- Google Power Meter
  - Goggle partners with your energy provider through a google gadget to monitor and manage your power usage
- Microsoft Hohm
  - Also allows you to monitor and manage your power usage
  - You can compare your energy usage to your neighbors'
  - Build a project list with the goal of reducing energy consumption

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Questions?

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